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so rare as to escape common notice, there are about 68 species of trees common in some part of the valley, often throughout it. A short popular account of most of these, illustrated by lantern-slides, aimed to bring out the salient features of the different kinds, and to draw attention to their principal economic or cultural uses."

Adjourned.

PERCY WILSON,  
*Secretary*

## OF INTEREST TO TEACHERS \*

BY W. F. GANONG

### SOME REFLECTIONS UPON BOTANICAL EDUCATION IN AMERICA

I come now to the fourth of the reasons why our science teaching is defective, and that is the most vital of all. *Our method of training teachers is wrong.* I believe it is true that in general our educational advances work down from above—from university to college, from college to high school and from high school to the grades; and in a general way each of these institutions is the finishing school for teachers of the grade below. Now the work of our universities is for the most part admirable in every way, but they are not good training schools for college teachers. One of the greatest of our college presidents lately remarked that the principal obstacle in the way of making a college what it ought to be is the difficulty nowadays of securing the right kind of teachers. "We have to take them as the universities supply them," he said, "and then make them into good college teachers afterwards." The defects of the universities in this respect are two-fold. First they are training students only for their own kind of activity, in which everything centers, very properly, in research; and second, they are omitting to teach divers matters very essential for the college teacher to know.

That our universities make research the central feature and great leading method of their training of graduate students is

\*Address of the retiring president of the Botanical Society of America, delivered at Boston, December 28, 1909. Reprinted by permission from *Science*, March 4, 1910. See TORREYA for May and June.

natural, logical and correct, so far as training for their own kind of activity is concerned; but it ignores the fact that only a minority can remain in that work. The justification of the training of all by a method which is correct only for a minority is usually expressed in this form, that he is the best teacher who is an active investigator. Now if this is qualified by the proviso "other things being equal," it is approximately true; but in fact other things very rarely are equal, and in the matter under discussion they are profoundly unequal. In my opinion the imposition upon all university students of the university research ideal is doing vast harm to our teaching in college and therefore in high school. For one thing, it sends out ambitious young men imbued with the feeling that they must maintain their research at all costs, or else forfeit the good opinion of their teachers, the possibility of membership in the best scientific societies, and especially any chance for a call to university work, though this latter point should not be given great weight, since to a person with a liking for teaching a good college offers as attractive a career as a university. In consequence there is a continual pressure on the teacher to subordinate his teaching to research. Now in college and high school this is wrong, ethically and practically. A college teacher is never engaged for research, but for a very different purpose, and it is his first duty to carry out that purpose to the very best of his ability. If there is any man who can carry on active investigation and at the same time do college or high school work as well as if he were concentrating wholly on that, the man is fortunate, and so is the institution which has him. But in fact this can rarely be true. For one thing, the limitations of time and strength prevent it in most cases; and for another the qualities and temper required for the two activities are not only different but somewhat antagonistic. Research requires concentration and much consecutive time fixed by the nature of the work, while the teacher must be ready for constant interruptions, and must regulate his time to fit the schedules of his students. To one immersed in the critical stage of an investigation the little troubles of students seem absurdly trivial, if not stupid, and under their application for aid he is almost

more than human if he can keep a sweet temper and not answer with repellant brusqueness. To the good teacher, the troubles of students are never trivial, but rather are welcome as means to the advancement of his particular interests. Furthermore, I believe that the research ideal imposed on all men trained in the universities is the cause not only of much injury to teaching, but of much unhappiness to teachers. For if the teacher be conscientious, and gives his first strength to his teaching, he is soon doing his research upon the ragged ends of his nerves. I venture to say that many a teacher to-day is wishing he could afford to abandon all attempts at abstract research and turn whole-souled to his teaching and matters connected therewith. And when, indeed, he does so, he finds his happiness and his usefulness alike immensely augmented. I know this is true, for I have been through it. It took me many long years to free myself from the feeling that I must continue research or else sacrifice the good opinion of my colleagues. But I am free, and in the two or three years I have been so the added keenness of my pleasure in my teaching, and in various activities related thereto, has been such as to make me feel like a Sinbad who has dropped his old man of the sea. And if there are any among you who believe that I stay in a society given to research only under false pretenses, I ask you to have patience a little, for I purpose to try to convince the society that its rules ought so to be altered as to make teaching, of approved merit and service, a sufficient qualification for membership. Meanwhile I advise all of my colleagues engaged in collegiate work to join in my declaration of independence. Let us show the universities that teaching hath her victories no less than research.

But now I am going to qualify a little. When I say research I mean abstract research, of the university type, the kind which has place on the skirmish line of the forefront of advancing knowledge. In truth I agree that he is the best teacher who is also an active investigator, but I maintain that in the case of college teachers the investigation ought to have some kind of connection with the teaching. This is entirely possible, for a vast and fruitful field for research lies open in educational organization, in the

introduction of more logical, useful and illuminating topics, experiments and methods, in the fitting of science better to the growing mind, in local floras and the natural history of common plants, in ways for better collation and diffusion of knowledge. After all, it is the spirit of the investigation that is the matter of value to the teacher, not the results. A contemplation of the status of much of the investigation put forth by busy teachers somehow seems to suggest a saying of one of our senior botanists, who was in his youth somewhat of a botanical explorer, and always a genial wit. Apropos of the making of bread in camp he has been heard to remark "it may not result in very good bread, but it's great for cleaning the hands." In investigation as elsewhere, results are most surely and economically won by experts, selected, trained and devoted to that work. The college teacher would do better not to waste his strength on a field in which he can be little better than an amateur, especially when there lies open another in which he can himself be an expert, and that is in educational-scientific investigation.

From this which the university ought not to do, I turn now to things which it leaves undone. It is not giving to those who are to be college teachers certain knowledge and training which are indispensable to good teaching. Thus, it does not insist that they shall know the common facts about the familiar plants around them. The old type of botanical course, consisting in the study of the morphology and identification of the higher plants, is gone forever, not because it was not good, but because the expansion of knowledge has given us something still better. Yet the knowledge involved in the old course is indispensable to every teaching botanist, and I would have a requirement made that no person could be recommended as a competent botanical teacher for a college until he had spent at least two summers of active field work on the critical study of some flora. Again, most of our university-trained teachers know nothing more of the historical or biographical phases of the sciences than they may have picked up incidentally. Yet for purposes of teaching, a knowledge of the history of the science itself, and of its relations to other great matters, is vastly important, in part for the

favorable background it offers for the projection of our present-day knowledge, and in part for the purpose of placing the dramatic, heroic and humanistic aspects of the science at the disposal of the teacher. Again, the teacher may go forth from the university without any other than the most fragmentary knowledge of laboratory administration, although there is a rapidly developing technique of efficient and economical management of laboratory construction, furniture, apparatus, supplies, materials, manipulation; and the lack of any training in these is one reason why our science is so often disgraced, and our influence weakened, by slovenly botanical laboratories. Again, the teacher takes up the instruction of young people without any knowledge whatever of the results, very valuable, all imperfect though they still are, which have been won in the scientific study of the psychology of the adolescent mind. And finally he receives no training in the collation and exposition of scientific knowledge, a subject of such importance that I shall speak of it in a moment apart. Training in investigation he also needs, of course, and that he now gets with ample efficiency. We need a standardization of preparation for college and high-school teaching of the sciences, with appropriate titles or degrees. We are as yet far enough from such a condition, but not wholly without some progress to record. For one university, Chicago, in its school of education, has a department of botany and natural history, administered, by the way, by one of our members and colleagues whose accomplishments in the past give promise of great service to come.

But now once more I wish to qualify a little. While I believe that a training in common knowledge of plants, in the history of our science, in laboratory administration, in the psychology of youth, in the collation and exposition of knowledge, as well as in investigation, is indispensable to the best botanical teaching, and should be included compulsorily in the training of botanical teachers, I do not blame the universities for not providing such instruction, nor am I sure that it is a correct or economical university function. But there is one thing of which I am sure, and it is this, that there is a place in which such training is practicable and wholly appropriate and that place is the graduate department of the college.

Just here I wish to turn aside for a moment to consider a bit more this matter of training in the collation and exposition of knowledge. The expansion of science in our day has been so vast, the literature has become so voluminous, the specialization of method and thought are so extreme, that it is becoming a serious question how the results of new research, when not of a sensational nature, can be quickly, accurately and adequately incorporated into the general mass of our knowledge and made available to the intellectual or economic uses of our race. Every scientific man has witnessed the ignoring of new truth long after its announcement, and the repetition of old error long after its disproval, not alone in popular information and literature, but even in the best scientific text-books; and this mal-adjustment between scientific research and general knowledge waxes constantly greater. The trouble is plain; we have no recognized collators of knowledge, scholars whose business it is to stand between the investigator and the general user of knowledge and to interpret correctly the results of the one to the other. The need for such service was pointed out long ago by Francis Bacon. In his prophecy of the future development of scientific knowledge, veiled under his story of "The New Atlantis," he describes the division of duty among the scholars of Salomon's House. He says :

"Then after divers meetings and consults of our whole number, to consider of the former labours and collections [an obvious prophesy of our scientific meetings], we have three that take care, out of them, to direct new experiments, of a higher light, more penetrating into nature than the former. These we call Lamps. . . . Lastly, we have three that raise the former discoveries by experiments into greater observations, axioms, and aphorisms. These we call Interpreters of Nature."

To-day we have our lamps, and their light shines steadily and benignantly forth. We call them universities. But where are our interpreters of nature? Though we need them, we have them not. They should be our colleges. In all of the great body of intellectual endeavor there is no greater weakness and no greater opportunity for service, than in the interpretation to all

men of the results secured by research, not in science alone, but in other departments of knowledge as well. It is the absence of such interpreters which leaves room for the charlatans of knowledge, the mendacious reporter who uses his bit of college information to give a specious semblance of truth to his investigations or exaggerations, and the nature fakir whose literary skill is his sole qualification. This interpretation of knowledge is no easy matter. Compilation will not do, for the interpreter must repeat observations and experiments far enough to give him a personal and familiar grasp of the materials. Nor even is a first-hand knowledge of the materials enough; he must also be able to set them forth in exposition with a combination of pedagogical clearness and literary force. So little developed is the interpretation of knowledge in comparison with its acquisition that although we have many strong journals devoted to research we have almost none devoted to interpretation and exposition. We have two or three popular journals, carried on by the devotion of loyal individuals, but with all the conditions for success against them. A suitable journal for the collation, interpretation and diffusion of botanical knowledge can only be conducted by an institution whose credit is involved in its permanence and efficiency. It should be marked by dignified form, artistic dress, and literary grace, with departments covering so completely their fields that no person with a serious interest in the science can possibly afford, and much less be willing, to be without it. Such a journal must of course be heavily subsidized, or endowed, especially at first; but there is not at present any place in the educational structure where an endowment would tell so heavily. It would be worth more to education than the endowment of any professorship that I can think of, even a professorship of botanical education in my own college. Such a journal should issue from a college, not a university. I would like to edit it, and I have the plans worked out in complete detail; but I shall not undertake it unless the business foundation can first be made secure.

Not only does the training of interpreters of nature, and of other knowledge as well, whether as teachers, as writers, through the editing of suitable journals, or other activities, seem wholly



appropriate to a college, but I think it would offer the colleges themselves a mission which would react grandly on their general efficiency. There is an agreement that the first function of the college is the training of young people in the qualities which go to make more effective members of organized human society. But there is also a general feeling that somehow this is not by itself quite sufficient, for while it offers a worthy and amply difficult educational service, it does not provide a sufficiently-absorbing intellectual interest. Our colleges require, for the maintenance of high intellectual tone, both of students and of teachers, some more vigorous intellectual resistance than undergraduates alone can offer. It is in response to this feeling that some colleges have established graduate work, but in all cases, so far as I know, of the investigation or university type. For such work, however, our students should be sent to a university, which can provide far better than any college the facilities, companionship and atmosphere essential to its successful pursuit. To encourage young people, who are never well informed upon these matters and who do not understand the differences between institutions, to come to a college for work of the university type, is little better than attracting them under false pretenses. It would be much better for our educational system if the colleges would do no graduate work at all, unless they can offer something which they can do better than the university. In the training of their own and high-school teachers, and other interpreters of knowledge, they have, from the very nature of their activities and the presence right at hand of the best of all practice schools, a work which they can do better than the university. I hope ere long to see, in one of our greater colleges, the establishment of the first graduate school devoted to the training of these interpreters of knowledge.

But now I have reached the bounds which custom and courtesy allow to a speaker for this kind of address, and although I think with regret of the many large matters I fain would include to make my account of this subject complete, I must come to a close. I shall add but one thing, which is this—a summary of the objects for which we should work.

1. A continuous and adequate system of nature study in the schools, so complete and so good as to send every student into the high schools with no prejudice against science, and with a solid foundation of natural fact knowledge.

2. A four-years' course in the high school in the standard sciences, upon exactly the same basis of efficient teaching and educational dignity as any other subjects whatever, being required in so far as they are required, and elective in so far as they are elective.

3. A system of education in the college which will preserve the golden principle of the elective system—viz., the fact that the mind like the body derives greater good from an exercise in which it can take an interest than from one in which it does not—while pruning away the absurdities that have been allowed to graft themselves thereon. The logical system is the group system, in which the student is free to choose his group, but having once chosen it, finds his studies arranged on a plan approved as wise by educational experience. We must not expect a majority ever to choose the science groups, but those who do should receive a training qualitatively equal to that in any subjects whatever, and, above all, thoroughly but humanistically scientific.

4. A critical review and retesting of our present educational methods and material, with a view to the elimination of the impracticable, the replacement of the mediocre, and the introduction of the better, to be sought through critical educational research.

5. A system of training of teachers which shall recognize that college teachers and university investigators are not one and the same, but fellow craftsmen, entitled to equal honor for equal achievement. The training of the university investigator belongs to the university, but of the college teacher to the college, which should establish the suitable instruction in the practical and humanistic phases of the subject. And since the college teacher is from his profession primarily an interpreter of knowledge, he should make that his particular field; and the colleges should cherish and develop, as their particular function, all activities connected therewith.

These things, I believe, will make the sciences free from their

present educational disabilities. It is true they will not give us perfection. But what is perfection, and who wants it? Perfection, so I fancy, for I never have seen it, is in this like truth, that there is more pleasure in seeking than in finding it. Besides, man, for whom we are doing it all, is imperfect, though the extent thereof depends upon the point from which we view him. If one were to look down upon him from the place of the angels towards which he likes to believe he is ascending, he must seem a very poor creature, deserving only of pity. But if one looks up after him from the place of the beasts from which we know he has risen, then he looms as a very grand figure, worthy of credit and honor. After all, perfect or imperfect, good, bad or indifferent, he is the very best thing of which we are sure. It behooves us, therefore, to make the most of him.

SMITH COLLEGE

#### NEWS ITEMS

Mr. John Burroughs has recently received an honorary degree, LL.D., from Yale University.

Dr. Ernst A. Bessy, of the Louisiana State University, has been made professor of botany at the Michigan Agricultural College.

Dr. J. E. Kirkwood has been advanced to professor-in-charge of the new department of botany and forestry at the University of Montana.

Professor H. H. Rusby, while continuing his rubber investigations in Mexico, is collecting economic and medicinal material for the New York Botanical Garden.

At the New York Botanical Garden the four o'clock lectures which will be continued into September include the following: "Edible Mushrooms," by W. A. Murrill, August 6; "Influences which Govern Local Distribution of Plants," by Norman Taylor, August 13; "Botanical Cruises among the Bahamas," by Dr. M. A. Howe, August 20; "Grasses and their Economic Importance," by George V. Nash, August 27; "Poisonous Mushrooms," by Dr. W. A. Murrill, September 3; and "European Influences in the History of American Botany," by Dr. J. H. Barnhart, September 10.